ALTURAS LAKE CREEK FLOW AUGMENTATION

Final Report

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SUMMARY

Diversion of stream flow in the upper Salmon River Basin for irrigation purposes has substantially reduced chinook salmon production capability. The two most significant instream flow conflicts are in Alturas Lake Creek (ALC) and the upper Salmon River (USR).

In April of 1983, the Sawtooth National Forest entered into a contract with Bonneville Power Administration (BPA) to determine flow augmentation alternatives for Alturas Lake Creek for the purposes of allowing passage of chinook salmon and to reestablish sockeye salmon production in the Alturas Lake Basin of the upper Salmon River.

Two alternatives were outlined in the first statement of work as possibilities for flow augmentation in Alturas Lake Creek. The alternatives were to raise the level of Alturas Lake and to acquire necessary water rights in Alturas Lake Creek.

The first alternative considered in the study was raising the water level at Alturas Lake with a low head dam. Raising Alturas Lake, appeared feasible in that it provided the necessary fish flows in Alturas Lake Creek. However, raising the level of Alturas Lake had adverse effects to other resources and forced pursuing the second alternative as defined in this report. Some of these effects included:

1. Flooding Smokey Bear boat ramp.
2. Inundation of recreation beaches for extended periods.
3. Flooding of the campground and some of the road system.
4. Potentially contaminating the quality of lake water from flooded toilet vaults.
5. Destroying the conifer canopy around the lake.

Maintenance and operation costs of the dam, along with the need to have a watermaster to distribute flows over the course of the irrigation season, raised additional concerns that detracted from this alternative.

The second alternative considered was the acquisition of water rights. This led to an appraisal of the water right values which was completed by BPA with a comparison appraisal done by the Forest Service.

As the water right study on Alturas Lake Creek proceeded, it became apparent that dewatering of the Salmon River needed to be resolved at the same time. One alternative consideration was the construction of a fish bypass at the Salmon

River diversion, to include the installation of wells to supplement stream flows at the bypass. Also, another possible solution to the dewatering of Alturas Lake Creek and the Salmon River could be accomplished by more efficient use of water for irrigation purposes on the Busterback Ranch.

In the spring of 1986, the Alturas Lake Creek flow augmentation contract with BPA and the Forest Service was amended and extended for another year to determine if, by improving irrigation efficiency, sufficient instreams flows could be maintained in the Salmon River and Alturas Lake Creek to pass the chinook salmon. The Forest Service let a contract with the Soil Conservation Service (SCS) to determine the most efficient use of water for irrigation purposes (Appendix E). The study by the SCS, as a part of this agreement, shows that by improving irrigation efficiency, all of the affected lands on the Busterback Ranch could be irrigated from the upper Salmon River while still meeting the instream flow needs of chinook salmon in the upper Salmon River and Alturas Lake Creek. The unused water rights could be purchased.

Total project costs could exceed $1.5 million; however, chinook smolt production capability could increase 340,000 annually, while sockeye smolt production capability could increase 540,000 per year.

INTRODUCTION AND BACKGROUND

Diversion of water for irrigation has affected the character of aquatic environments in the upper Salmon Basin since shortly after the first ranch appeared in Sawtooth Valley in 1899. Between 1905 and 1930, irrigation development expanded rapidly as almost all valley bottomlands were taken up under the Homestead Act. Since 1930, the number of acres irrigated has gradually increased, as has the demand for a limited water resource. Many diversion structures are now capable of diverting entire streams, leaving the natural channels below them dry. Diversion dams on Alturas Lake Creek and the main Salmon River are the two most significant examples of such structures.

Water rights on Alturas Lake Creek and the upper Salmon River are held and utilized in concert to irrigate the 2,400-acre Busterback Ranch. It has become apparent through the course of the feasibility analysis that resolution of the Alturas Lake Creek problem may be closely tied to resolution of the upper Salmon River instream flow problem; thus, the evaluation was expanded to include resolution of the upper Salmon River conflict.

Dewatering these natural channels results in direct losses of chinook salmon spawning and rearing habitats below the dams and prevents chinook and sockeye salmon access to vast spawning and rearing habitats upstream from the structures. The reduction in production capability is very substantial. Resolution of these instream flow conflicts is recognized by the Idaho Department of Fish and Game, Shoshone/Bannock Indian Tribes, and the Forest Service as one of the largest and most important "habitat improvement and passage restoration" opportunities, identified under program measure 704(d)(l) of the NWPPC's Fish and Wildlife Plan for off-site mitigation in Idaho.

1. <u>Alturas Lake Creek</u>

Alturas Lake Creek is a tributary to the upper Salmon River and originates at 8,960 feet elevation in the Sawtooth National Recreation Area. From its source, the stream courses in a general north-easterly direction dropping 2,130 feet in 15.5 miles (137 feet/mile) to its confluence with the Salmon River (Figure 1). The stream passes through two natural lakes, Alturas Lake (838 acres) and Perkins Lake (51 acres), which receive extensive recreational use during the summer season. Below the lakes, four main tributaries and subsurface seepage enter the stream; above the lakes, no other source contributes to its volume. An irrigation diversion below the lakes completely dewaters the stream during most years, limiting use of the stream by anadromous fish.

Historically, spring chinook spawned and reared in Alturas Lake Creek above and below the lakes and in Alpine Creek, a tributary of Alturas Lake Creek, for approximately 1.5 miles. Some use of Alturas Lake Creek by summer steelhead also occurred. Sockeye salmon spawned in the upper drainage and reared in Alturas Lake.

Resident salmonids in Alturas Lake Creek are rainbow trout, cutthroat trout, bull trout, brook trout, and mountain whitefish; the brook trout are introduced, as are the kokanee which were stocked in Alturas Lake. Several species of cyprinids and catastomids occur in the two lakes and in the stream near the outlets.

Approximately 4.8 miles upstream from the junction of Alturas Lake Creek with the main Salmon River, an irrigation diversion dam usually diverts all flow after the first week of July (Figure 2). Most of the potential chinook spawning habitat and more than 80 percent of the suitable rearing habitat exists upstream from the diversion (Forsgren, personal communication, 1987). The stream is dewatered for 1.6 miles below this diversion during the largest part of the chinook spawning season. Since there is no fish screen at the diversion, all smolts migrating downstream enter the irrigation system when flows are diverted. In the lower stream reach, Vat Creek and subsurface flows do provide sufficient water to Alturas Lake Creek for suitable spawning and rearing conditions in most years. In addition to reducing chinook and steelhead production potential, the diversion eliminated a sockeye run.

2. <u>Upper Salmon River</u>

The Salmon River, 410 miles long, has its source, more than 900-river miles from the Pacific Ocean, in the Sawtooth Mountains within the Idaho Batholith, a region with highly erodible soils. The upper river above Stanley (Figure 1) lies entirely within the Sawtooth National Recreation Area which was created by Congress in 1972 to ensure, through PL 92-400, the preservation and protection of the natural, scenic, historic, pastoral, and fish and wildlife values. The upper river flows through a relatively flat basin. Flow diversions for irrigation restrict anadromous fish use to parts of the lower portions of the basin, and grazing of domestic livestock in riparian zones has degraded aquatic habitat in parts of the basin.

The upper Salmon River system is a major production area for spring chinook salmon. To a lesser degree, the upper basin produces summer steelhead. A remnant run of sockeye salmon rears in Redfish Lake. Anadromous ffsh runs to the upper Salmon River were reduced in the early 1900's by construction of Sunbeam Dam downstream from Stanley. The dam, which was almost a total barrier to anadromous fish, was breached in 1934. The upper Salmon River was not restocked extensively in the years following the dam removal (Reingold, personal communication, 1987). Compensation for losses of spring chinook at the lower Snake River Projects led to recent construction of the Sawtooth Hatchery near Stanley under the Lower Snake River Compensation Plan. A brood stock development program, involving trapping of adults and release of smolts, has been in operation since 1981.

Native resident salmonids in the upper Salmon River drainage are rainbow trout, cutthroat trout, bull trout, and mountain whitefish . Non-native brook trout have also become established.

An irrigation diversion on the Salmon River between the confluence of Alturas Lake Creek and Pole Creek dewaters the stream for about one-quarter mile during late summer in most years. Passage for adult chinook is restricted during these years, and rearing habitat is reduced for juvenile steelhead and chinook. A ladder was constructed on the diversion structure in 1981, but is not effective during low flow periods. Informal arrangements have been made with a private caretaker to check the ladder and to open it, if adult chinook were beginning to concentrate in the dewatered area (Reingold, personal communication, 1987), Improvements undertaken on Pole Creek through the cooperation of the landowner will be realized when the problem of the upper Salmon River passage is resolved.

GOALS AND OBJECTIVES

The project goal is to increase the production potential of chinook and sockeye salmon in the upper Salmon River Basin. This will be accomplished by meeting the following objectives:

1. Providing returning adult spawners access to a large expanse of prime chinook and sockeye salmon spawning and rearing habitats lying upstream from the diversion dams; and

2. Increasing both the quantity and quality of spawning and rearing habitat for chinook salmon by rewatering stream reaches downstream from diversion structures.

Attainment of these goals will be enhanced by extensive outplants of juvenile chinook and sockeye salmon from the recently completed Sawtooth Hatchery to reestablish naturally reproducing salmon populations in the affected habitats.

APPROACH

Diversion of stream flow in the upper Salmon River Basin for irrigation purposes has substantially reduced chinook salmon production capability. The two most significant instream flow conflicts are in Alturas Lake Creek and the upper Salmon River. Water rights on Alturas Lake Creek and the upper Salmon River are held and utilized in concert to irrigate the 2,400-acres Busterback Ranch.

Project 83-415 was initiated by the Sawtooth National Forest under BPA contract in 1983 to evaluate the feasibility of augmenting stream flow in Alturas Lake Creek, and as amended, the upper Salmon River. Various alternatives to solve the problem have been evaluated, and two basic approaches to resolution have surfaced. The two approaches are:

1. Storage of spring runoff in Alturas Lake for later release; and

2. Acquisition of all or part of the existing water right to meet anadromous fish needs.

During the evaluation of these two approaches, it became apparent that the second approach would not only allow for the Alturas Lake Creek instream flow passage, but would also accomplish Salmon River passage. By improving irrigation efficiency, all of the affected lands could be irrigated from the Salmon River while still meeting the instream flow needs of chinook in the Salmon River and Alturas Lake Creek. Diversion from Alturas Lake Creek for irrigation of the Breckenridge and Enright ranches would be eliminated. The acquisition of existing water rights is supported by the Forest Service (the entire project area is within the Sawtooth National Recreation Area, which has legal right to control development of private lands within the Sawtooth National Recreation Area), Idaho Department of Fish and Game, and the Shoshone/Bannock Indian Tribes.

By increasing irrigation efficiency, water use during base flow periods would be reduced from 70+ cfs to 20-27 cfs. The Instream Flow Group 4 (IFG-4) method was used to determine that adequate fish passage flows for Alturas Lake Creek are 15 cfs and 25 cfs, for the upper Salmon River, while minimum fish production flows would require 10 cfs for Alturas Lake Creek and 21 cfs for the Salmon River.

This would satisfy the fish screens and improved flows, all of which serve to provide adult passage upstream. The other items concerning riparian degradation in this measure are being addressed in Project No. 84-24, an agreement with the Intermountain Region (USDA FS).

Total project costs could exceed $1.5 million; however, chinook smolt production capability could increase 342,000 annually, while sockeye smolt production capability could increase 542,000 per year.

ANTICIPATED INCREASE IN SMOLT PRODUCTION

The anticipated increase in smolt production capability is detailed by stream in Table 1. Information in this table suggests implementation of this approach would result in an annual increase in production capability of 884,000 smolt.

EVALUATION AND MONITORING

Evaluation and monitoring of fish populations in Alturas Lake Creek and the upper Salmon River has been accomplished by the Idaho Department of Fish and Game under separate contract with the Bonneville Power Administration.

1. Monitoring Survey

   Idaho Department of Fish and Game conducted a precondition survey of Alturas Lake Creek in 1984, which included a determination of juvenile steelhead and chinook distributions and densities and a habitat inventory. Six sample sections were established: two below the diversion, two between the diversion and the lakes, and two above the lakes (Figure 2). During August 1984, Idaho Department of Fish and Game biologists snorkeled sections, measured section lengths and widths (Table 2), surveyed the physical habitat, and determined fish densities by species and age group. Findings from the 1984 survey are summarized below.

   Rainbow-steelhead were present only in the lower Sections 2, 3, and 4 (Table 3: Figure 2). Densities of juvenile rainbow-steelhead were lower than in most other Idaho streams.

   Age 0 chinook were present in all sections, but in much lower densities upstream of the diversion in 1984 (Table 3; Figure 2). Density of age 0 chinook in Section 3 near Vat Creek confluence was among the highest observed for Idaho streams in 1984. No age 0 chinook were observed above Alturas Lake in 1985 or 1986.

   The only locations that either sockeye or kokanee were observed were Section lA, above Alturas Lake, and Section 1, downstream from Perkins Lake (Table 3). High densities of brook trout were observed in the meadow Section (3) near Vat Creek confluence. In Section 1, downstream from Perkins Lake, high densities of squawfish, suckers, and chubs were observed.

   In mid-August 1984, when Alturas Lake Creek was inventoried, the diversion served as a total block to upstream migration. The stream was almost completely dewatered below the diversion. Age 0 chinook were observed in Sections 1, 2, lA, and 2A above the diversion, but in low densities. These fish were probably progeny from a few adults that returned early in 1983 before complete flow diversion occurred. Presence of any age 0 chinook above Alturas Lake was surprising in view of recent depressed spawning escapements and the irrigation diversion.

   Physical habitat varied considerably among the six sections in Alturas Lake Creek in 1984 (Figure 3). Section 4 near the mouth and Section 2 above the diversion were similar in terms of their relatively high velocities, large substrate, and low embeddedness. Section 1 below Perkins Lake was a highly sedimented flat run. Habitat measurements in Section 1A and 2A above Alturas Lake most closely resemble those in Section 3 near Vat Creek, which supported the stream's highest density of age 0 chinook in 1984. In general, habitat quality in Alturas Lake Creek was high and comparable to that in the upper Salmon River.

Resolution of the instream flow problems at the diversion would benefit chinook production in three ways. First, better passage would allow for seeding of high-quality habitat upstream of the diversion. Secondly, higher instream flows would increase the quantity and quality of rearing habitat downstream from the diversion during summer and early fall. Finally, salmonids migrating downstream would not be lost when the flows are diverted for flood irrigation.

Estimates of the numbers of age 0 chinook rearing in the three zones of Alturas Lake Creek during 1984 were made based on densities in the sections and amount of rearing habitat in each zone. In the lower 3.2 miles below the irrigation diversion that maintained a flow in 1984, an estimated 26,500 age 0 chinook were present during August; in the 1.6 miles below the diversion that was dewatered another 13,000 chinook could have reared, given adequate flows (assuming similar density). Between the diversion and Perkins Lake, an estimated 2,400 age 0 chinook reared in 1984. In the 6.7 miles of available habitat above Alturas Lake, only 134 age 0 chinook were estimated to be present during August 1984. Precision of these estimates can be improved in future years when full seeding is approached by adding more sections and stratifying habitat into general types. However, it is clear that the high-quality habitat upstream of the diversion was underseeded in 1984.

Enhancement of the spring chinook run in Alturas Lake Creek above the lakes could be difficult if these fish are of a unique stock. Alturas and Perkins Lakes present an unusual migratory route for adult chinook and smolts which are spawned above the lakes. Under present circumstances, adults returning to that portion of the stream must not only return early enough to pass the diversion dam before flow is diverted, but must also find their way through two natural lakes. Apparently, this group is wild in origin and was not supplemented by past stocking above the lakes. If chinook returning to the upper reach of Alturas Lake Creek are unique, seeding of this prime habitat may also be impeded due to current hatchery operations on the Salmon River. Since 1981, Sawtooth Fish Hatchery has attempted to capture a major portion of chinook adults returning to the upper Salmon River system.

In 1983, approximately 400 adults escaped capture before the hatchery weir was operational on July 20. An additional 78 male and 19 female adults were released above the hatchery weir following capture. In 1984, an unknown number of adults passed before the weir was operational, and only 140 male and 65 female adults were released after the hatchery weir was operational. Because their release occurred after July 11 and total flow diversion in Alturas Lake Creek began the first week in July, it is doubtful that any of those released adults continued upstream to spawn above Alturas Lake. Adult redd counts and juvenile snorkel surveys in 1985 and 1986 revealed that no chinook production was occurring above the lake in 1985 and 1986.

Idaho Department of Fish and Game surveyed sections of the upper Salmon River in 1984 and 1985 to determine fish distribution and densities and document current physical habitat conditions. Idaho Department of Fish and Game biologists established six sections on the upper Salmon River between the confluence of Alturas Lake Creek and the U.S. Highway 93 bridge near Galena Summit (Figure 4). Idaho Department of Fish and Game snorkeled the sections during August 1984 and 1985, measured section lengths, and widths (Table 4), surveyed the physical habitat, and determined fish densities by species and age group. Findings from the 1984 and 1985 surveys are summarized in Tables 4 and 5 and Figure 4. Densities of juvenile rainbow-steelhead (Table 5) in the upper Salmon River sections were low relative to those in other streams surveyed in 1984.

2. Impact Assessment

An interdisciplinary team, consisting of a landscape architect, hydrologist, soil scientist, recreation planner, archaeologist, forester, and fisheries biologist has completed evaluation of the issues, concerns, and opportunities associated with the impound/flow release alternative. Assessment of the impacts associated with the other alternatives (increasing irrigation efficiency and water right acquisition) to resolve the instream flow conflicts has been done.

Evaluation of the feasibility of augmenting stream flows in Alturas Lake Creek and resolving a related instream flow problem on the main Salmon River to provide chinook salmon passage, spawning and egg incubation has been completed.

3. Recommendations

The acquisition of sufficient water rights to ensure passage of anadromous fish species in Alturas Lake Creek and the Salmon River.

Reintroduction of sockeye back into Alturas Lake. Special consideration should be given to sustain the remnant wild spring chinook run above Alturas Lake.

An upstream and downstream migrant facility should be incorporated into the design of any irrigation diversion structure that may be built to evaluate both chinook and sockeye production enhancement as part of Idaho Department of Fish and Game's intensive anadromous fish production studies.

PROBLEM, WORK PLAN/SCHEDULE DEVIATIONS

The focus of this project on solving the fisheries problems has provided valuable information. However, this information must be used in conjunction with other information; e.g., scenic easement requirements, private land regulations, before resolution can be achieved.

PROJECT COSTS

Project costs up to July 1986 totaled $111,111.21, for which the BPA reimbursed the USFS. Since 1986 no substantial expenses have accrued.

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Forsgren, H. (personal communication, 1987) Mt. Hood National Forest, Gresham, Oregon.

Northwest Power Planning Council. 1984. Columbia River Basin Fish and Wildlife Program. 130 pages.

Reingold, M. (personal communication, 1987) Idaho Department of Fish and Game, Salmon, Idaho.

Roberts, Gail. 1986. Salmon River Irrigation Water Management Report. USDA-Soil Conservation Service. 23 pages.

APPENDICES

APPENDIX A: Figures 1 to 4

SALMON RIVER

North Fork to Headwaters

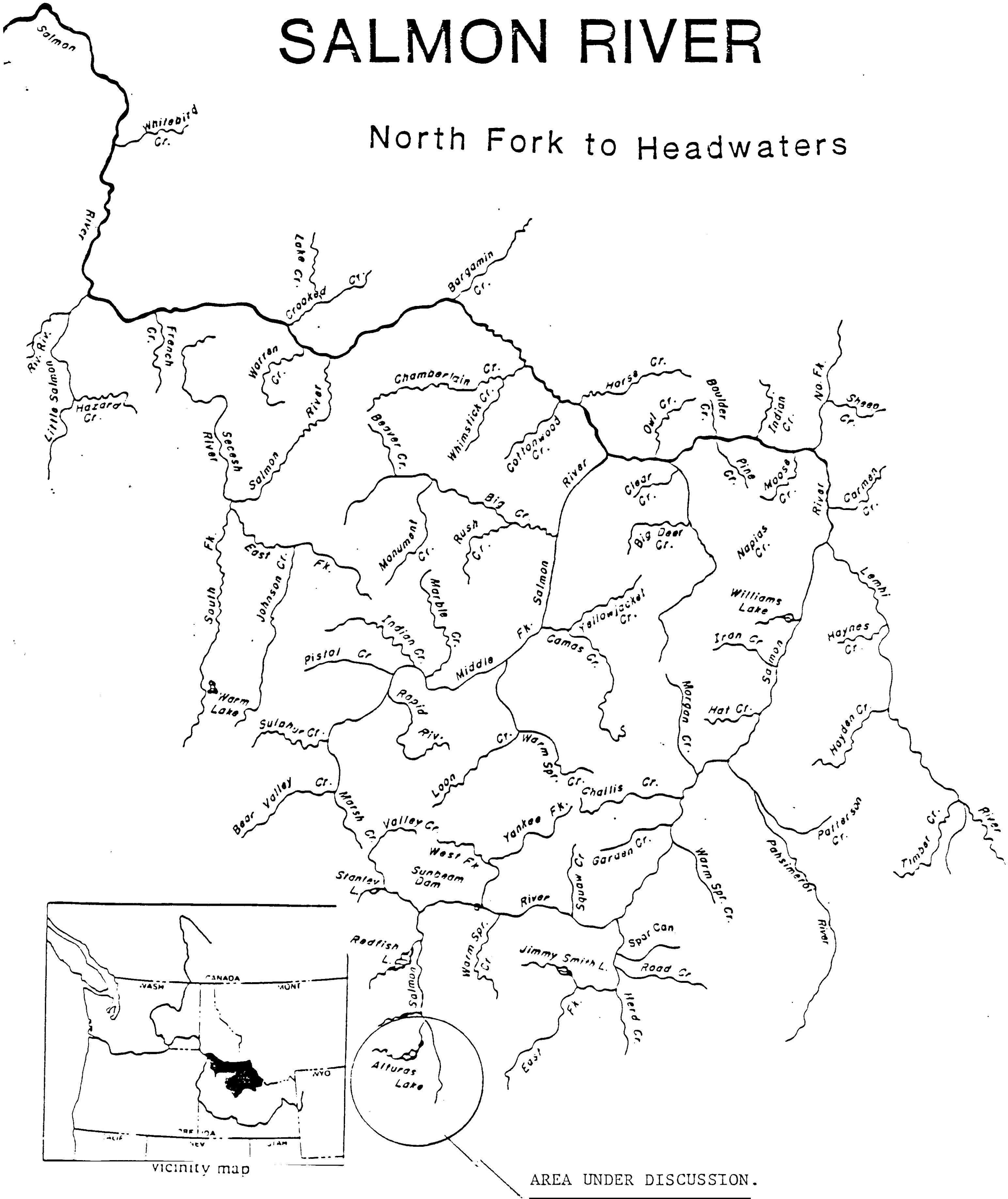


Figure 1. Location of area.

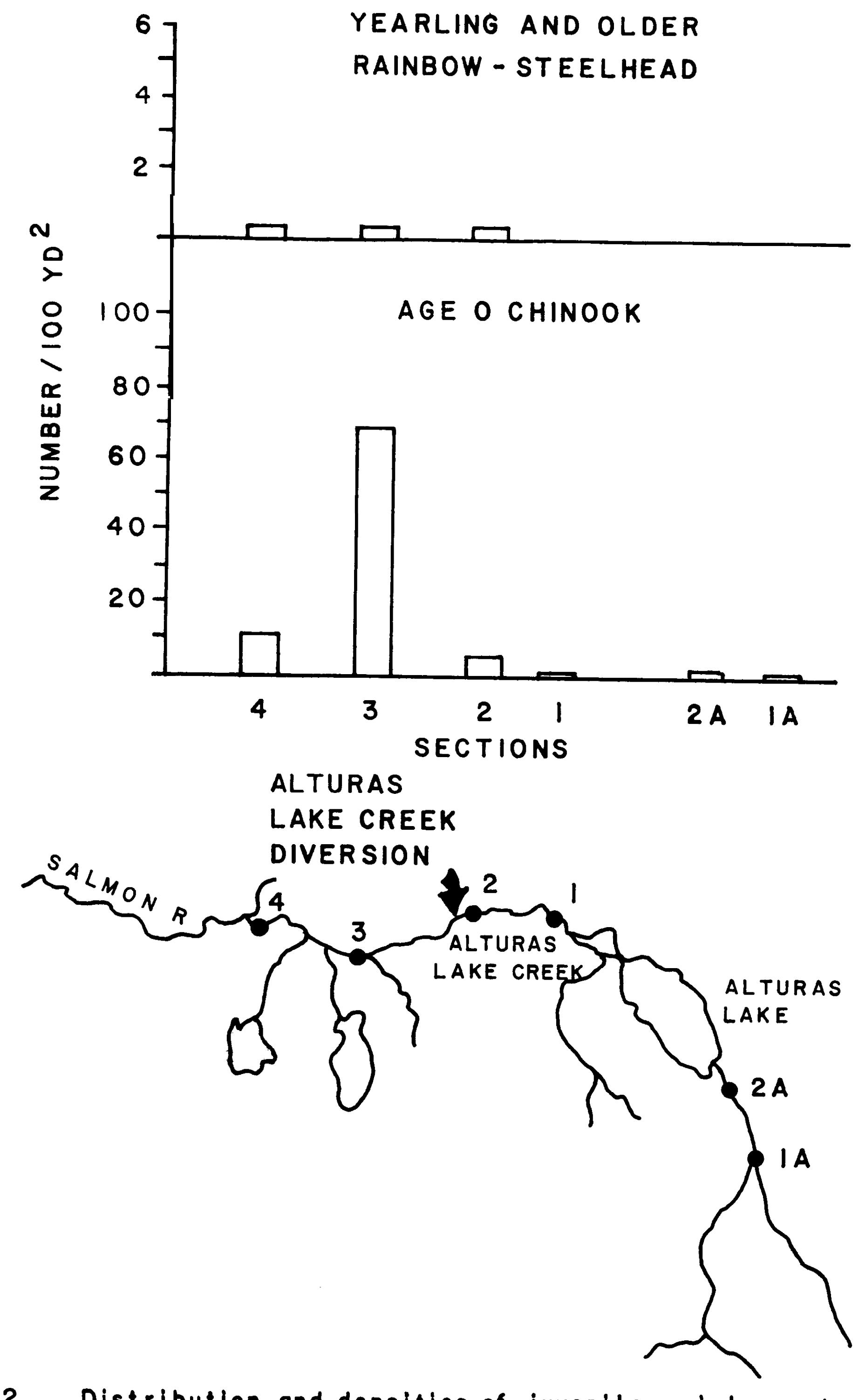


Figure 2 Distribution and densities of juvenile rainbow-steelhead and chinook in Alturas Lake Creek relative to irrigation diversion, August 18-19, 1984.

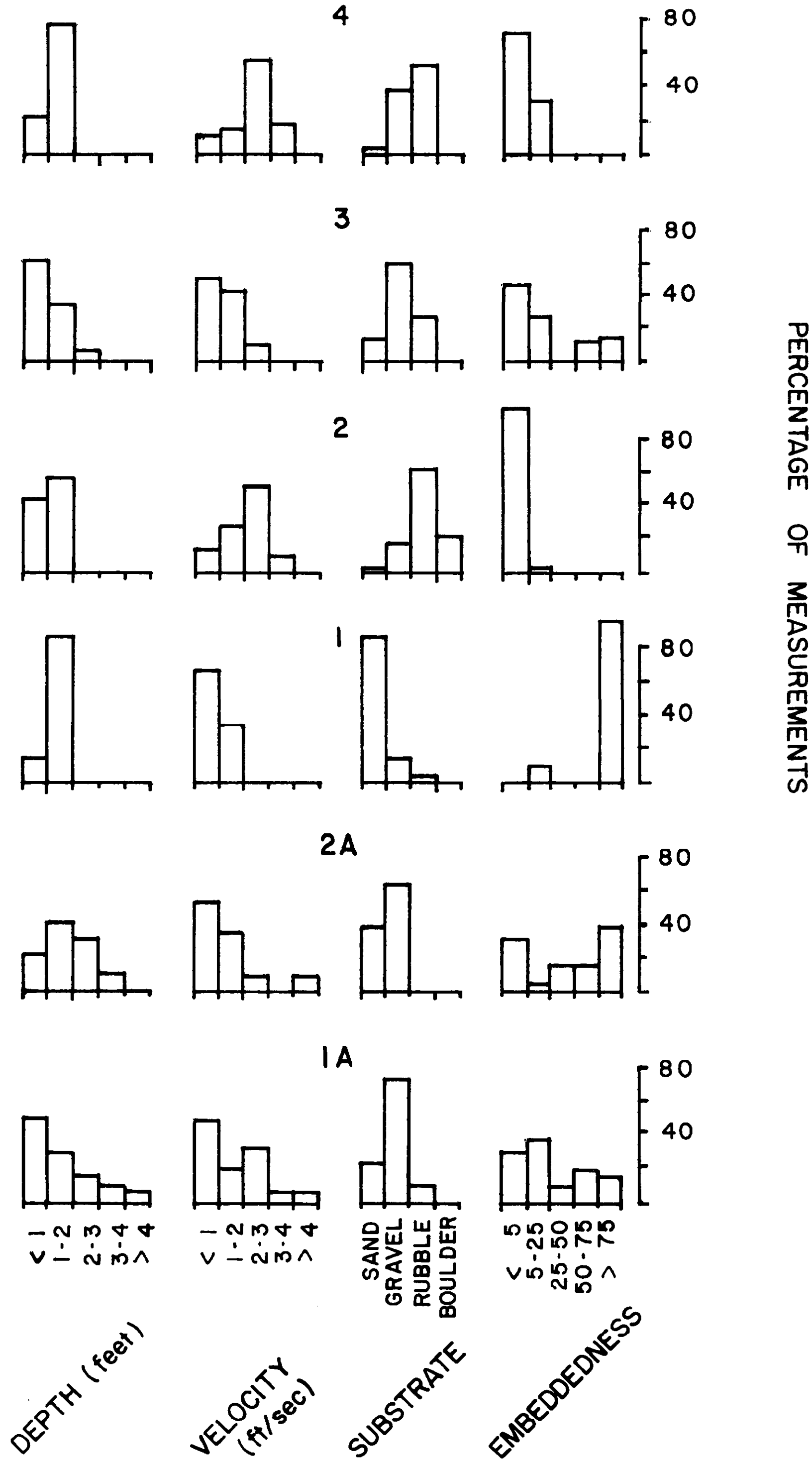


Figure 3 Summary of physical habitat measurements in Alturas Lake Creek sections, August 18-19, 1984, for sites identified in Figure 2.

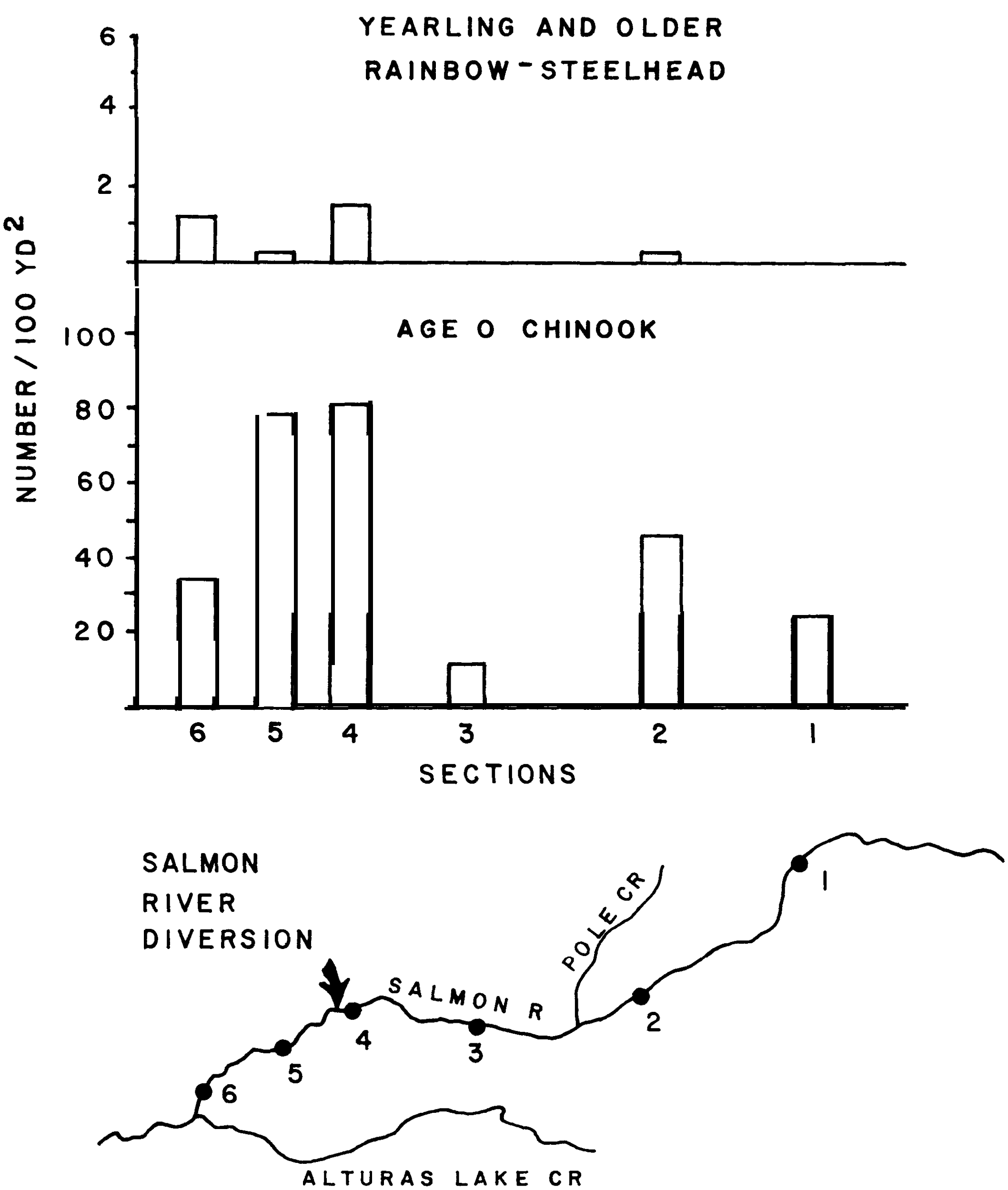


Figure 4 Distribution and densities of juvenile rainbow-steelhead and chinook in upper Salmon River relative to irrigation diversion, August 20-21, 1984.

APPENDIX B: Tables 1 to 5

APPENDIX B

TABLES 1 TO 5: STREAM SURVEYS

Table 1. Anticipated increase in annual smolt production capability by resolving instream flow conflicts in Alturas Lake Creek and the Upper Main Salmon River.

STREAM	SPECIES	ANNUAL INCREASE IN SMOLT PRODUCTION CAPABILITY
Alturas Lake Creek	Chinook	120,000
	Sockeye	542,000
Salmon River	Chinook	222,000
	TOTAL	884,000 1/

(1) Total increase in smolt production capability are considered very conservative estimates by Idaho Department of Fish and Game. These estimates are based on the number of square meters in the study multiplied by the predicted smolt production density for the area.

Table 2. Sections sampled in Alturas Lake Creek, August 18-19, 1984.

Section	Length (yd)	Mean Width +25E(yd)	Area (yd)2	% Habitat Type			
				Pool	Run	Riffle	Pocket Water
1A a/,b/	100	8.3 + 0.9	825	63.3	3.3	33.3	0
2A a/ ,b/	100	8.0 + 0.9	797	85.2	0	14.8	0
1 a/	100	23.7 + 1.4	2367	0	100.0	0	0
2 a/	100	12.3 + 1.8	1230	0	11.1	44.4	44.4
3	200	8.9 + 1.3	1807	0	71.7	28.3	0
4	91	18.5 + 2.2	1680	0	66.7	33.3	0

a/ Above diversion
b/ Above Alturas Lake

Table 3. Number of trout, salmon, and whitefish (number/LOO yd2) counted in Alturas Lake Creek sections, August 18-19, 1984.

Species and Age	Above Alturas Lake					
	ABOVE DIVERSION				BELOW DIVERSION	
	1A	2A	1	2	3	4
Rainbow-steelhead						
0	0	0	0	0	0	3(0.2)
I a/	0	0	0	0	0	0
II a/	0	0	0	4(0.3)	7(0.4)	8(0.5)
>III a/	0	0	0	1(0.1)	0	0
Chinook						
0	1(0.1)	8(1.0)	2(0.1)	70(5.7)	1237(68.5)	176(10.5)
>I	0	0	1(+) b/	5(0.4)	66(3.7)	8(0.5)
Kokanee						
0	O	0	1(+) b/	0	0	0
>I	7(0.9)	0	0	0	0	0
Brook						
0	4(0.5)	0	0	0	8	0
>I	20(2.4)	22(2.4)	8(0.3)	15(1.2)	221(12.2)	46(2.7)
Hatchery rainbow	0	0	0	0	0	1(0.1)
Whitefish						
0	0	0	0	0	0	0
>I	0	2(0.3)	9(0.4)	8(0.7)	22(1.2)	27(1.6)

a/ Ages I, II, and >III correspond to length-classes 3u-5u, 6u-8u, and $\geq$9u, respectively.

b/ Present of density 0.1/100 yd2.

Table 4. Sections sampled in Upper Salmon River, August 20-21, 1984.

Section	Length (yd)	Mean Width +25E(yd)	Area (yd)2	% Habitat Type Pool	Run	Riffle	Pocket Water
1 a/	100	4.6 + 1.2	457	26.7	60.0	13.3	0
2 a/	200	6.2 + 0.7	1231	0	63.3	36.7	0
3 a/	100	12.4 ± 1.0	1237	0	44.4	55.6	0
4 a/	97	11.4 ± 0.5	1108	30.0	36.7	33.3	0
5	100	8.7 ± 1.4	871	40.0	20.0	40.0	0
6	100	13.1 ± 1.8	1305	36.7	30.0	33.3	0

a/ Above diversion

Table 5. Number of trout, salmon, and whitefish (number/100 yd2) counted in Upper Salmon River sections, August 20-21, 1984.

Species and Age	Above Alturas Lake A B O V E	D I V E R S I O N			B E L O W	D I V E R S I O N
	1	2	3	4	5	6
Rainbow-steelhead						
0	25(5.5)	4(0.3)	0	0	0	0
I a/	0	0	0	3(0.3)	1(0.1)	7(0.5)
II a/	0	1(0.1)	0	9(0.8)	0	7(0.5)
>III a/	0	1(0.1)	0	6(0.5)	1(0.1)	2(0.2)
Chinook						
0	105(23.5)	548(44.5)	134(10.8)	903(81.5)	690(79.2)	450(34.5)
I+	8(1.8)	5(0.4)	0	0	3(0.3)	10(0.8)
Brook						
0	0	0	0	0	0	0
>I	2(0.4)	2(0.2)	0	0	0	0
Hatchery rainbow						
	0	0	0	0	0	5(0.4)
Whitefish						
0	1(0.2)	5(0.4)	0	168(15.2)	5(0.6)	1(0.1)
>I	4(0.9)	12(1.0)	2(0.2)	50(4.5)	14(1.6)	51(3.9)

a/ Ages I, II, and >III correspond to length-classes 3^{u}-5^{u}, 6^{u}-8^{u}, and $\geq 9^{u}$, respectively.

APPENDIX C: Photographs

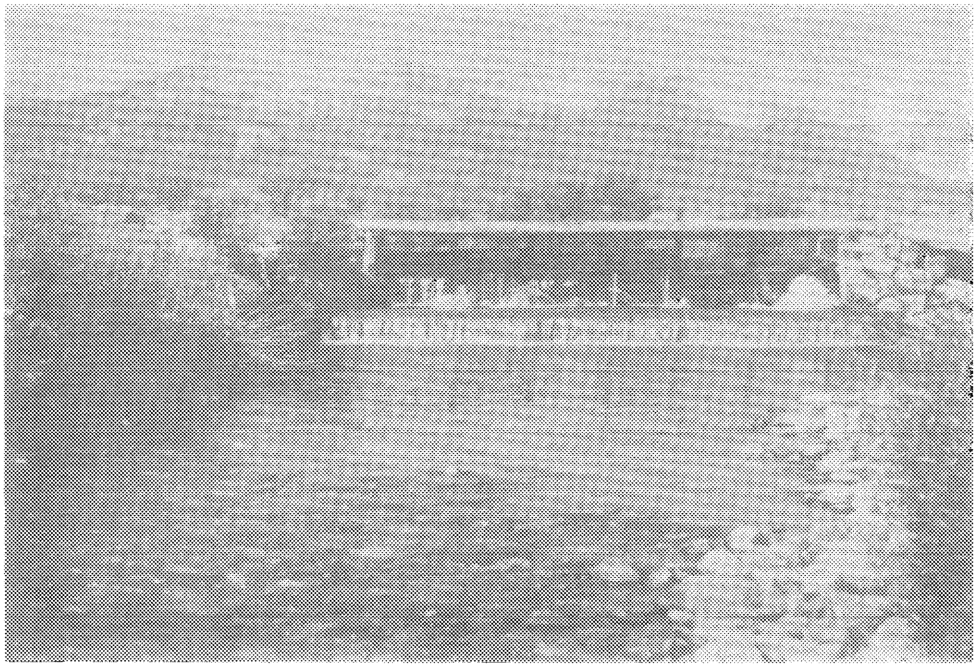


PHOTO 1.
Breckenridge Diversion Dam, Upper Salmon River. Water gate open.

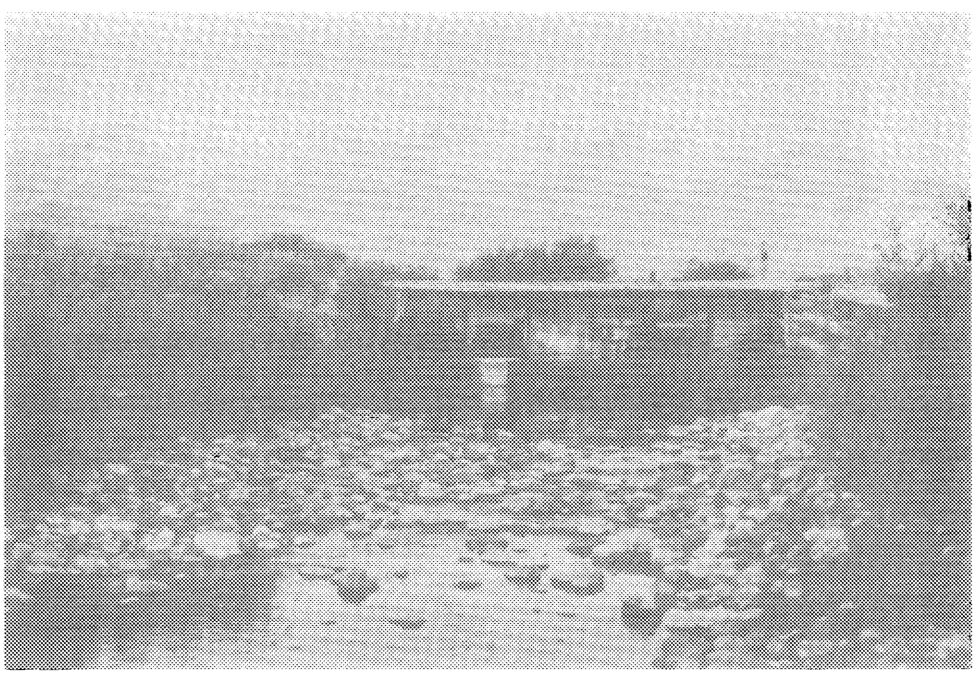


PHOTO 2.
Breckenridge Diversion Dam, Upper Salmon River. Water gate closed.

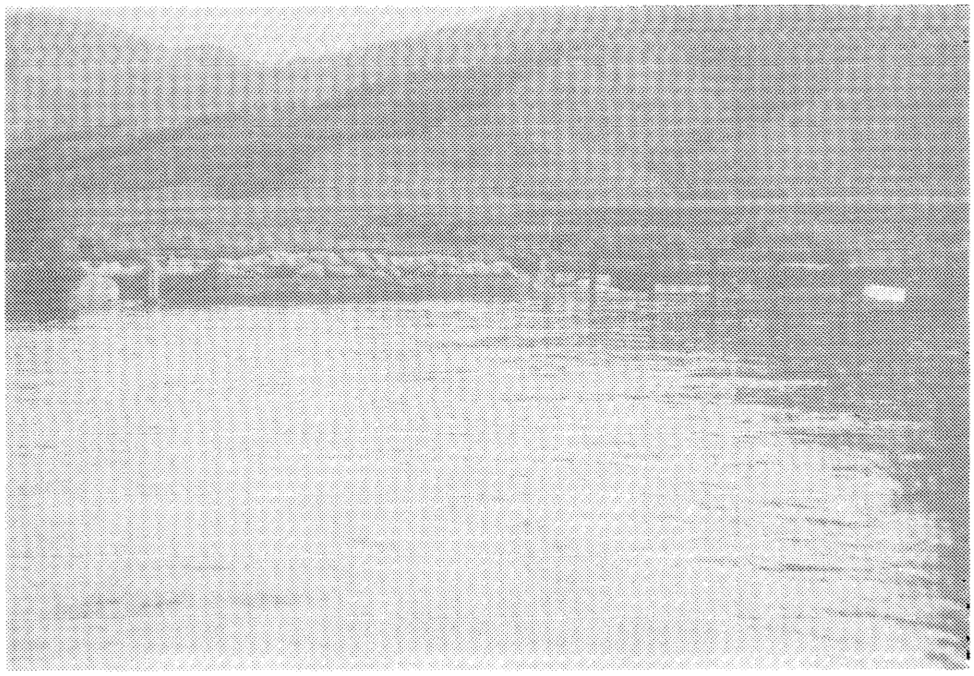


PHOTO 3.

Upper Salmon River above Diversion Dam.

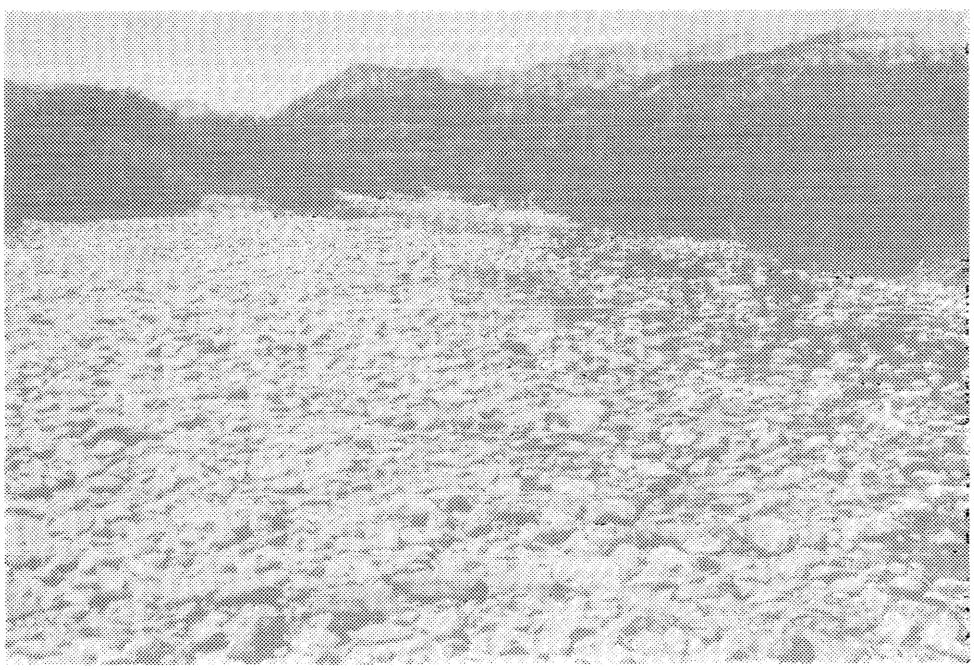


PHOTO 4.

Upper Salmon River below Diversion Dam.

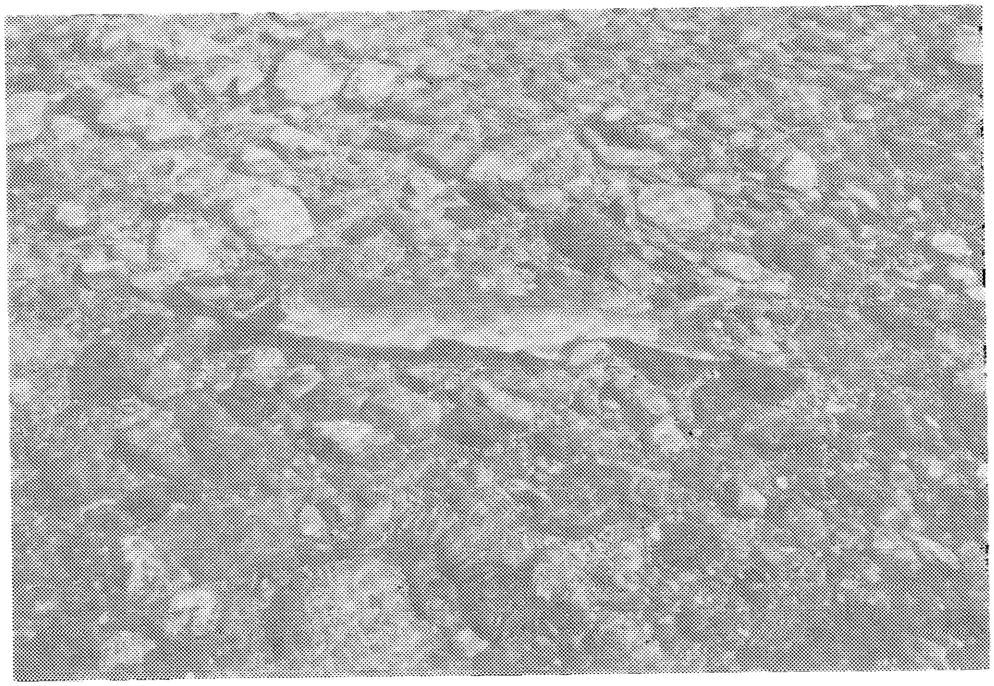


PHOTO 5.

Salmon mortality at
Breckenridge Diversion Dam,
Upper Salmon River.

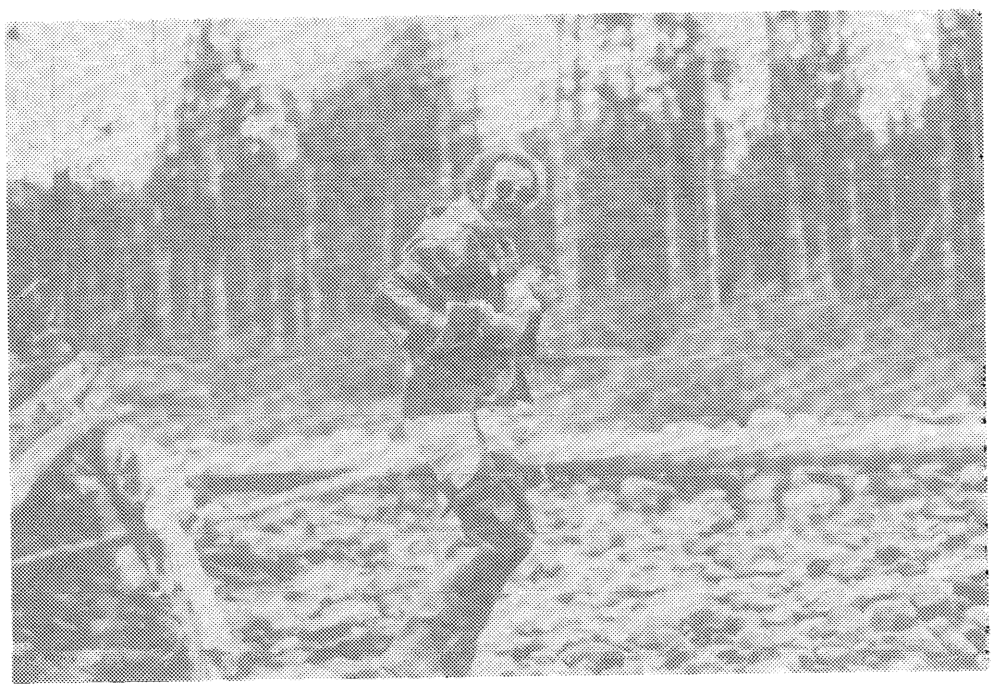


PHOTO 6.

Rescue of salmon in Alturas
Lake Creek.

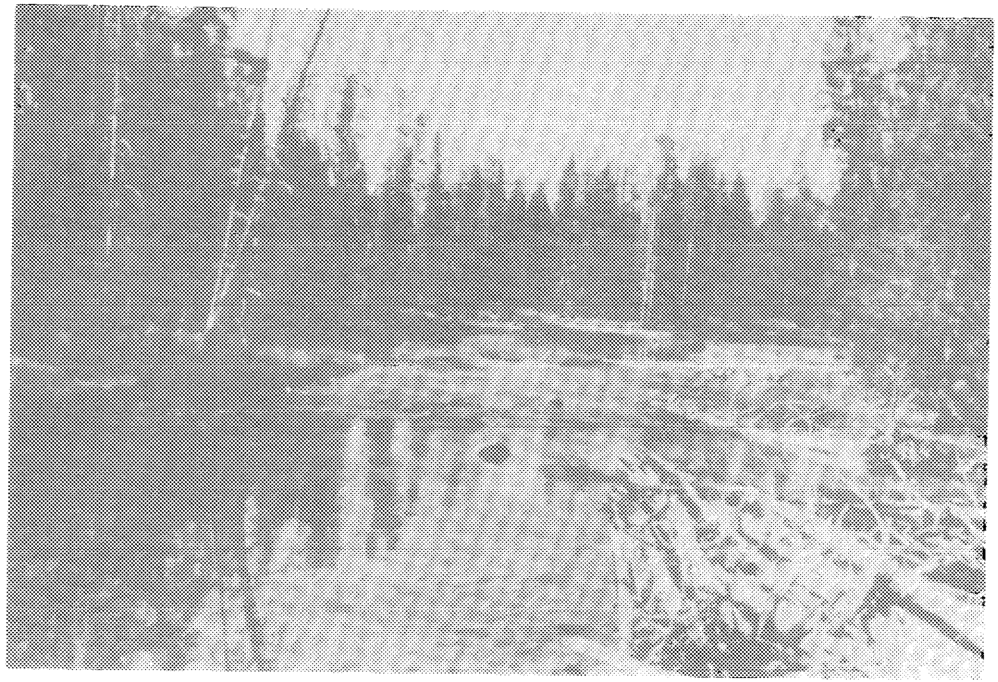


PHOTO 7.

Alturas Lake Creek. Salmon habitat above dam diversion.

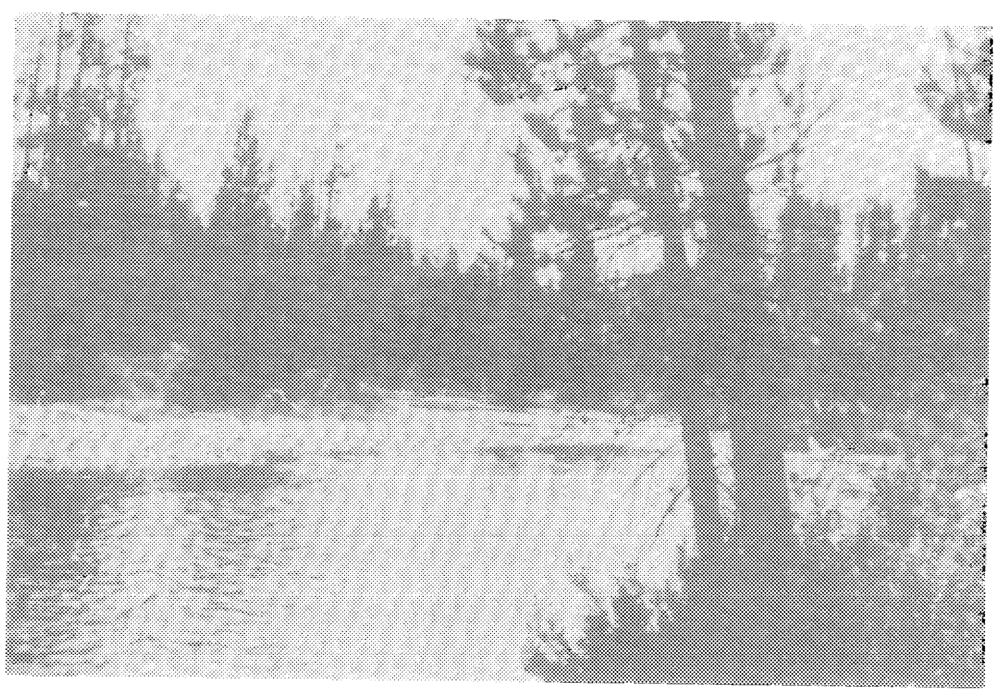


PHOTO 8.

Alturas Lake Creek. Salmon habitat above dam diversion.

APPENDIX D: Engineering Notes

ENGINEERING NOTES

The purpose of this project is to create a reservoir atop Alturas Lake which can be released through the control structure to sustain flows in Alturas Lake Creek capable of allowing fish passage.

The proposed project is of the size and purpose to consider it in the category of structures in the irrigation/diversion classification, rather than the dam classification. The structure requires only a simple outlet gate (rather than full-fledged outlet works) and is designed to withstand long-term periods of overtopping. The structure only controls the upper 1.7 feet of water atop Alturas Lake; its failure would not cause an uncontrolled release of the entire lake volume.

This type of structure mandates ease of operation and maintenance due to its sustained use and remote location. Since it must support a dynamic population regime, utmost consideration has been taken to design a structure strong enough to avoid interruptions for maintenance. Maintenance for this type of structure would have to be scheduled during low flow conditions; exactly at the same period of time when fish would require flows for passage. Likewise, the structure must be able to sustain vandalism and tampering due to its presence in a recreation area.

Ease of operation is essential since fishery biologists and technicians will be responsible for setting gate-release levels; therefore, it must be designed in the simplest manner possible. The Waterman type gate is one of the simplest, most problem-free water metering devices ever perfected. It is also incredibly durable and can be locked against tampering.

The structure, as designed, meets safety needs by offering overtop passage of calculated high flows in combination with full gate orifice passage. It has purposely been overdesigned for stability, resistance to weather, and safety of users.

In comparison with other structure types, the concrete design is preferred. Alternatives included treated log, rock-fill, and earthfill structures. These structures were not acceptable due to problems associated with maintenance, inability to seal leakage, inability to overtop, vulnerability to vandalism, and longevity (cost vs. length of interrupted service). The concrete structure accommodates the presence of the fish passageway in the safest, easiest manner.

Treated log barriers exhibit moderate to severe leakage, even when constructed with care, and deteriorate within a relatively short period of time (20-year maximum life). They are also subject to vandalism. In short for a structure this size, with a fish passageway, a timber barrier would be a waste of money.

Rock fill barriers also leak at intolerable rates, and they are extremely susceptible to vandalism.

Earth fill barriers cannot be overtopped and are not economically feasible for structures this small. The incorporation of asphalt coverings are costly and problematic in severe weather. Due to the presence of recreationists, an earth fill structure would suffer from foot and off road vehicle traffic.

The concrete design accommodates the presence of a fish passageway better than any of these alternatives.

The design used implements a top width with human safety in mind; it is wide enough to walk along safely. This is essential for gate operation. The downstream ledge is designed to eliminate streambed migration and facilitate foothold during the routine removal of debris from the spillway section.

In the case of the Ranch Diversion Structure, the same rationale applies, except this barrier must be capable of controlling a release for farmland irrigation.

synopsis : Concrete structures are preferred in consideration of cost versus life, maintenance, operation, stability, overtopping capability, and safety.

I have implemented your suggestions for the fish passageway design. I did not understand references of 3.36′, 2.85', @ 1.14: rounded off to nearest inch. I wonder if we can get a contractor to build in hundredths, if it is necessary due to fish preference (must be extremely sensitive fish) or hydraulics - you pencil in numbers. I really wish this input would have come forth when concept ___________ were sent up last year.

I have not received any comments from Sawtooth engineering. If there are tremendous concerns/changes, they must be transmitted soon as the flood season is upon us, and I will be assigned to the Emergency Task Force and unavailable until flows reduce (7/l).

Hopefully, we can communicate effectively without a FS signed letter from now on; that is the first negative letter I have received in 5 years worth of projects on hundreds of projects nationwide. A peripheral concern is the mixture of informal (not even speed memo) correspondence that has carried this project, and the absence of telecons in preference to negative letters.

Comments on cost calculations:

It looks like Leuze's calculations for materials are accurate; I have to depend upon local unit costs (that is why we did it this way). I would increase contingency cost estimates to 35 percent instead of 5 percent in consideration of diversion and wet excavation influences. In doing so, the respective cost estimates would be:

Alturas Lake Control Structure:	$33,372
Ranch Diversion Structure:	47,047
Total of both:	$80,419

Bill Curtis

ALTURAS LAKE CONTROL STRUCTURE (DAM)

CALCULATE CONCRETE QUANTITY

- WING WALLS - 4 each

45^{o} Lgth = /72 = 8.5 ft. long
Walls are 1" thick and 9-l/2' high

Therefore - $\frac{(4)(1)(9\ 5)(8.5)}{27'}$ = 12 yd. 3

- SPLASH APRON

81' long - 6' wide - 0.5' thick

Therefore - $\frac{(81)(6)(.5)}{27}$ = 9yd. 3

- BODY OF DAM

75' long, 2' thick, 8' high
Less spillway area of 25' long
by 2' thick by 1.3' high less
gate area of 3' by 3' X 2'

Therefore - $\frac{(75)(2)(8)-(25)(2)(1.3)-(3)(3)(21}{27}$

~~1200 - 65 - 18~~ = 41.4 yd. 3

- FISH LADDER

Bottom - 3' wide x 10' long x .5' thick
Walls (2) - 2.5 high x 10' long x .5 thick
Steps (4) - 2' long x 1' high x .5 Thick

Therefore - $\frac{13)(10)(.5)+(2)(2.5)(10)(.5)+(4)(2)(1)(.5)}{27}$

~~15 + 25 + 4~~ = 1.6 yd. 3

TOTAL CONCRETE IN DAM - 12 + 9 + 41.4 + 1.6 = 64 yd.3

ALTURAS DIVERSION STRUCTURE

CALCULATE CONCRETE QUANTITY

- BODY OF DIVERSION

142' long x 2' thick x 8′ high
Less spillway of 15' long x 2' thick x 1' high
Less two gates - one is 3′ x 3′ x 2' and the other is 3′ x 4.5′ x 2'

Therefore - $\frac{(142)(2)(8)-(15)(2)(1)-(3)(3)(3)-(3)(4.5)(2)}{27}$

~~2272 - 30 27 - 18 -~~ 27 = 81.4 yd.^{3}

SPLASH APRON

35′ long x .5′ thick x 6′ wide

Therefore - $\frac{(35(.5)(6)}{27}$ = 3.9 yd.^{3}

FISH LADDER

Same diversion as for dam -

Therefore - 1.6 yd.^{3}

TOTAL CONCRETE IN DIVERSION - 02.4 + 3.9 + 1.6 = 06.9 yd.^{3}

COST GUESSTIMATE

ASSUMPTIONS:

(1) Concrete is $250/YD in place including steel.
(2) Miscellaneous is 5 percent.
(3) Required excavation will equal 300 percent of concrete to be placed (working room) and will cost $35.00/yd.^{3}
(4) Gates are $2,000 each in place.

Therefore

Dam cost is:

(64 yd.3)(250.00)	=	$16,000.00
(300%)(64)(35.00)	=	6,720.00
(1)(2000.00)	=	2,000.00
		$24.720.00
Plus 5%	=	$25,956.00

Diversion structure is:

(86.9)(250.00)	=	$21,725.00
(300%)(86.9)(35.00)	=	9,124.50
(2)(2000.00)	=	4,000.00
		$34.849.50
Plus 5%	=	$36,591.98

Total

Dam and Diversion = $62,547.98

Per this estimate, costs gates and excavation should be compared with forthcoming estimates from RO.
Engineering and Sawtooth C & M Crew - (Bill Self and Joe Mallea)
Actual site conditions (wet) could make this estimate very conservative.

J. D. Leuze
11/16/84

Field Inspection of Alturas Lake August 4, 1983

Forest Supervisor, Sawtooth NF

In support of investigations by Harvey Forsgren, Fisheries Biologist (Sawtooth NF), Bill Self, Regional Dams and Hydraulics Engineer inspected Alturas Lake for potential dam construction on July 13 and 14.

It is Mr. Self's opinion that a concrete regulating dam could be built at the outlet of the lake. We presented a basic concept which would include a gated structure of less than 4 feet in height which would have a fish passage device and an overtop section. The concept, in terms of engineering and site acceptability appears fairly straightforward.

However, concerns exist for the impacts of raised lake surface elevation upon recreation facilities at the upper end of the lake. The currently undetermined raise in elevation could inundate portions of the campground and swimming beach. For this reason, it is apparent that the first step to take at this time is an elevation survey to define a series of l-, 2-, and 3-foot elevation increases. This information would dovetail into information being obtained by Mr. Forsgren during this summer relevant to storage amounts needed for sustained releases.

Mr. Self discussed this recommendation with Forest Engineer Dow Bond, who concurred with the need for elevation and plan view surveys. Mr. Bond stated that Forest level survey capabilities are extremely limited this summer.

To further discussions with John Potyondy, Region 4 Soil and Watershed Management, Mr. Self receives agreement that this proposed project is an excellent candidate for contract. A contract package to a private firm could include water balance analysis, necessary surveying, and control structure design/specifications.

Mr. Self remains available to assist as necessary.

/s/Sterling J. Wilcox
STERLING J. WILCOX
Director, Engineering

CC:
Sawtooth NF - Harvey Forsgren
S&WN - Potyondy

APPENDIX E: U.S.D.A. Soil Conservation Service Report (23 pages)

SALMON RIVER
IRRIGATION WATER MANAGEMENT
REPORT

Prepared by Gale Roberts of the

USDA-Soil Conservation Service
Hailey, Idaho

With Assistance from the SCS
Boise and Salmon, Idaho

for

USDA Forest Service

Draft: September 1985

Final: February 1986

Introduction

On April 1, 1985, the USDA Forest Service entered into a formal agreement with the USDA Soil Conservation Service to evaluate alternative methods of irrigating the Busterback Ranch. This ranch, located in the south end of the Stanley Basin, contains approximately 1,400 acres of irrigated pastureland It is currently irrigated by a surface system. This system diverts 70-150 cubic feet per second (CFS) of water from the Salmon River and Lake Aituras Creek to irrigate native and improved species of grass. Currently, the pasture provides forage for about 1,000-1,200 head of 650-900 pound steers from approximateiy June 1 until September 1.

When the ranch is using their full water right, the in-stream flow of the Salmon River and Lake Alturas Creek is inadequate for the passage and spawning of salmon during the late summer. Due to the course texture of the soils, it is not feasible to adequately meet the water requirements of the grass with a surface irrigation methods. Therefore, the new alternatives evaluated were sprinkler systems.

Specifically, the agreement called for the evaluation of three systems:

1. Approximately 1,132 acres of center pivot sprinklers on the east side of the highway, and 427 acres of improved surface irrigation on the west side of the highway;
2. Approximately 1,526 acres of center pivot sprinklers located on both sides of the highway; and
3. The existing system.

Seven specific items were to be addressed for each alternative:

1. Cost to install the irrigation system,
2. Cost to maintain the irrigation system,
3. Cost to operate the irrigation system,
4. Man-hours to operate the irrigation system,
5. Energy requirements to operate the irrigation system,
6. Water used and saved, and
7. Estimated forage and grazing production.

Before the actual evaluation was started, a detailed soil survey was completed on the area by SCS Soil Scientists.

This report is separated into four parts:

1. The Summary,
2. Forage Report,
3. Irrigation Report, and
4. Soils Report.

Because each report was prepared by a different specialist, some duplication of materials is evident.

Summary

Table la summarizes the three alternatives evaluated in this report. In addition, several other statements can be made with this information:

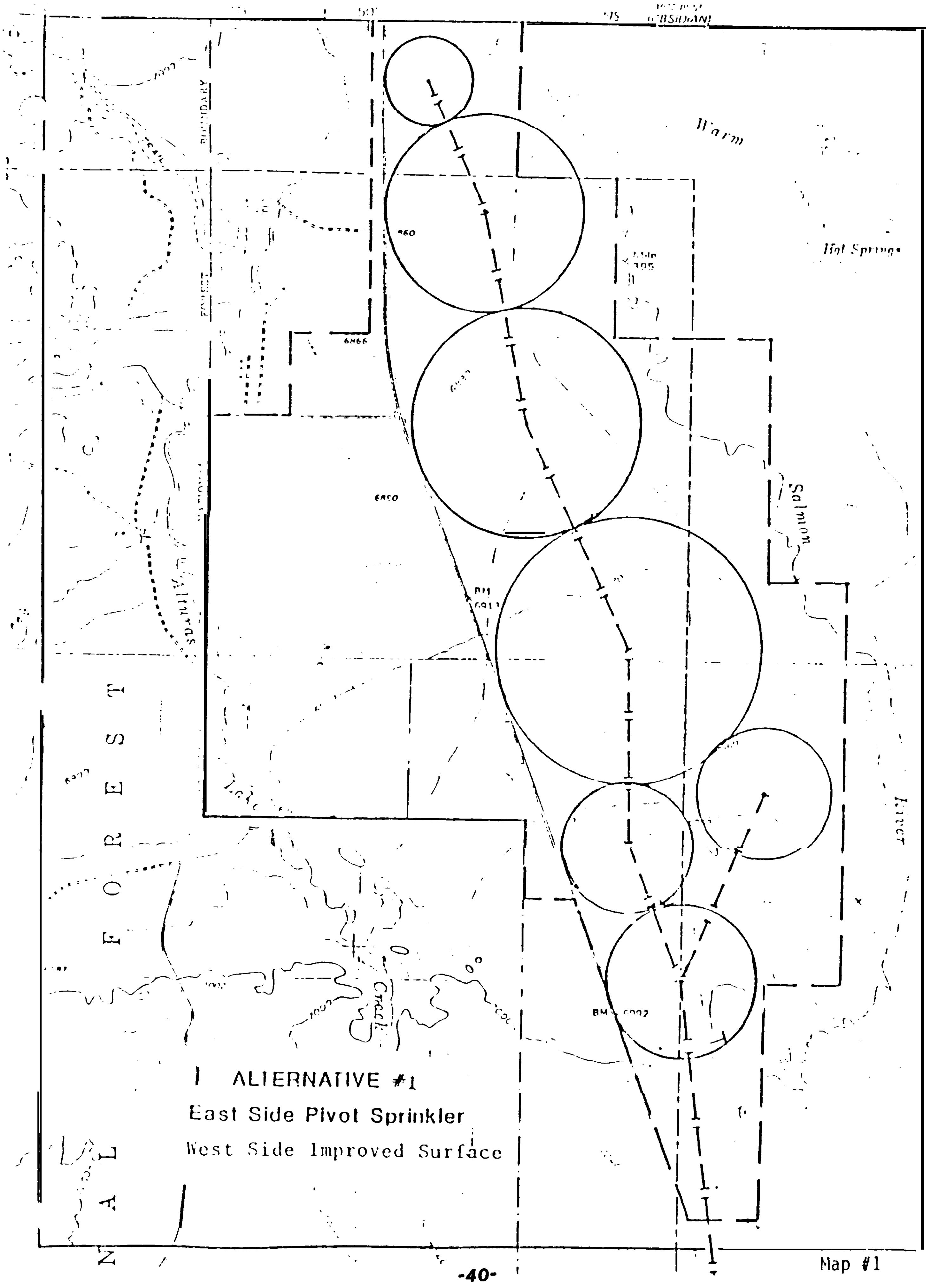
1. Pressurized, overhead sprinkler systems are the only feasibie method of efficiently applying irrigation water to the course-textured soils on the ranch. Center pivots greatly reduce the labor requirements over other methods, such as hand lines, or wheel lines.
2. The maximum increase in production can be achieved on the east side of the highway using sprinkiers, fertiiizer and improved plant species.
3. The increase in production on the west side of the road would be iess than the east side even with sprinklers. This is due to the water table that is supplying some of the crops* water requirements.
4. The mound or hill located north of the house should be considered a barrier to center pivots unless physically altered.
5. Gravity pressure from the elevation differences could provide most of the pressure to operate the sprinkler system.
6. The two new alternatives evaluated are both feasible methods of achieving the objectives. Other feasible layouts also exist and can be evaluated based on the material in this report.

Table 1a

Summary of Alternatives

Item	Alternative #1 1,132 Acres* 427 Acres**	Alternative #2 1,526 Acres*	Present 1,400 Acres**
Cost to Install Irrigation System	$964,200	$1,388,250	$ -0-
Annual Cost to Operate Irrigation System (Energy)	$ 30,030	$ 40,010	$ 2,000
Annual Labor Hours to Operate Irrigation System	4,000	2,000	6,000
Annual Energy Requirements	100 KW	107 KW	-0-
Annual Cost to Maintain Irrigation Sytem	$ 20,850	$ 27,765	$ 14,545
Carrying Capacity Level 1 (for 1,400 acres Level 2 currently irrigated) Level 3	1,580 hd 2,870 hd 3,540 hd	1,635 hd 2,890 hd 3,720 hd	1,112 hd
Water Requirements	30 CFS	19 CFS	70-150 CFS

*Sprinkler Irrigated
**Surface Irrigated

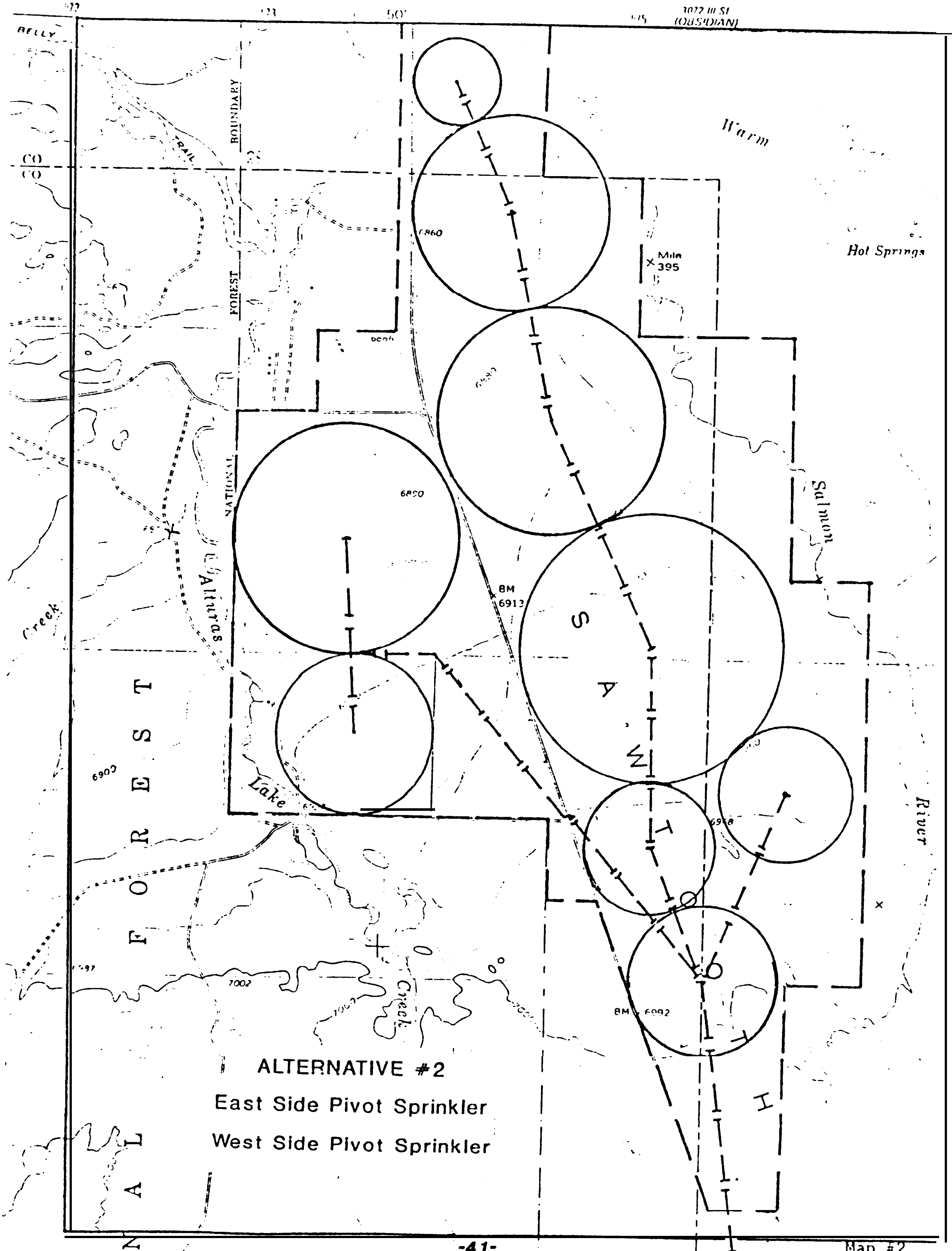


ALTERNATIVE #1

East Side Pivot Sprinkler

West Side Improved Surface

Map #1



ALTERNATIVE #2
East Side Pivot Sprinkler
West Side Pivot Sprinkler
Warm
Hot Springs
Mile 395
Salmon
River
SAWTH
FOREST
NATIONAL FOREST BOUNDARY
Altluras
Lake
Creek
BM 6913
BM 6992
6860
6850
6900
7002

Map #2

September 1985

Busterback Ranch Forage Production Report[1]

The Busterback Ranch is located in the south end of Idaho's Staniey Basin, about 20 miles south of the town of Stanley. It consists of approximately 1,400 acres of irrigated meadows along the Salmon River. Meadows on the ranch are used to graze steers from at least June 1 to September 1, each year. The normal stocking rate is from 1,000 to 1,200 head, or 1.4 to 1.2 acres per steer. Steers come onto the ranch in June at about 650 pounds and leave in September at about 850-900 pounds. Average daily gain is near 2.5 pounds per steer, per day.

Climate in the Stanley Basin is frigid. Frost may occur during any month of the year. Winters are severe with two to three feet of snow cover. The normal growing period is from 90 to 100 days for most grasses and forage plants. summers are generally warm and dry. The annual precipitation is 20 inches per year.

Present vegetatopm on the ranch consists primarily of native and introduced grass and forb species. In areas where the water table supplies plant needs, production is near 1.0 to 1.35 ton per acre, per year. On the more droughty soils, vegetative production is about .5 to .75 ton per acre, per year.

A large amount of conservation work has been applied to Soil A. Vegetation on this soil is mainly introduced species of Orchard grass and smooth brome grass. Yield responses from these introduced species have not been significant. The improved flood irrigation system does not adequately meet the plant moisture needs or ailow effective use of fertilizer; therefore, the production potentiai of these grasses is not being displayed.

Soils on the ranch are primarily very gravelly or gravelly, sandy loam soils. They tend to be droughty because the water holding capacity is very low. Water moves into and through them very fast. Soils west of the highway have a high water table with some areas near Alturas Creek having a very high water table. Because of the coarse nature of these soils, they are very difficult to irrigate in a manner that will meet the plant water requirement. Even though a rather elaborate fiood irrigatin system of ditches and leveling has been applied on Soil A, the plant moisture needs are still not being properly met. It is almost impossible to adequately control soil moisture on these soils with a flood irrigation system.

[1] By Floyd G. Bailey, State Conservation Agronomist, Soil Conservation Service, Boise, Idaho.

Present vegetative production estimates have been made for each soil group on the ranch. Numerous clipping measurements were made on each soii. These yieid data correlated well with the current livestock stocking rates. Table lb shows the current production rates and the estimated production in hay yieid, head of steers carried, and acres needed to feed one steer from June 1 to September 1 for each soil group. Potential yields have also been estimated for the improved management conditions of: (1) irrigation water management using a sprinkler system to adequately meet the plant water needs (Table 2b); (2) a sprinkler system, plus adding fertilizer to the plant (Table 3b); and (3) a sprinkler system, plus fertilization and changing vegetation to genetically, higher-yielding, introduced species (Table 4b).

Clipping data under sprinkler on the Frank Hensley Ranch located just south of the Busterback Ranch was used as a guide for the potential that could be reached under each management situation. The maximum potential production was set at 2.5 tons of hay per acre. Clippings on the Frank Hensley ranch showed this to be a reachable goal when high-level management conditions are applied to the land.

Information in this report is based on best estimates and field measurements. It is intended to show present yields and potential yields under different management conditions. Actual production rates may vary from the estimates presented herein due to actual management quaiity applied to the land.

Conclusions

Because of the gravelly nature of the soils on the Busterback Ranch, flood irrigation systems do not permit management to adequately meet the plant requirements for moisture. Excessive leaching also makes use of fertilizer uneconomical. Without proper irrigation water management, it is not feasible to use fertilizer technology and obtain crop response from improved species of grass and legumes.

Presently, yields are about l/4 to l/3 of the potential yield that can be expected when proper management conditions are applied. In order to take advantage of better management techniques, such as improved species and fertilization, a better system of managing irrigation will first have to be applied. Past experience has shown little response from either improved species or fertilizer when irrigation water cannot be adequately supplied. A realistic yield goal for the area under high-level management conditions is 2.5 tons of air-dry hay per acre. This is equivalent to approximately .4 acre per steer for the June 1 to September 1 grazing period.